CHAPTER XX

Bows and How to Make Them

By J. M. Challiss

THERE comes a time in the life of every archer, if he is of a mechanical turn, when he is not satisfied with the commercial bow which is available at moderate cost, nor is his proficiency sufficient to justify the expenditure necessary to procure a really good weapon, when he naturally inquires "Why cannot I make a bow?" and finding no serious opposition to his inquiry he proceeds to explore a very interesting field. If he is self taught and has never had the benefit of contact with real archers, or if he has only seen or used the imitation bows that are sold at curio shops as genuine Indian bows, his attempts at bow making are pathetic. And yet there is hardly any form of bow that the mind can conceive, or an amateur turn out that will not find its counterpart in the collection of Joseph Jessop, of San Diego, Cal., who has collected bows from all climes and all peoples. It is strange to note the fundamental

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Annual Tournament, N. A. A., Haverford, Pa., 1914

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principles that will guide a savage race in the fashioning of their bows, or rather the fashions they will follow. Many of them are diametrically opposed to what has been selected as the last word in bow construction among civilized peoples, and what experience has shown to be the best form to be followed. Yet these people who rely upon the bow in many instances for their sustenance find that their odd and misshapen weapons shoot and shoot hard. To sum the whole matter up a bow is simply a piece of wood, horn or metal, bent by the aid of a string and which propells an arrow by its tendency to assume its original position. Any stick that will bend will cast an arrow, some better than others. If the stick is fashioned in a certain shape it will cast the arrow better than if it is unformed, and this form constitutes the science and art of bow making. Modern archers have settled upon a bow that is flat on the back, round on the belly, gradually tapering to the tips and of about six feet in length as the desideratum. This is commonly known as the long bow. The bows of many savage tribes are much longer and a larger percentage of them much shorter. The much over-

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estimated American Indian archer used a shorter bow.

There is nothing intricate about bow making. Compared with the art of the fletcher it is like breaking sticks. You can make a bow out of most anything and in any form. Some are better than others, that is all. In the following remarks it is our purpose to give some simple directions, which if followed by one with slight skill and much care and patience, will result in turning out a conventional bow along English lines. The material out of which you will make your bow is the important question. If you consult the ordinary book or article on bows they will tell you that bows are made out of "yew, washaba or lance." That is very good. Where are you going to get the material? Did you ever see a tree of such? My Century Dictionary does not even tell me what washaba is. You can buy these expensive and imported woods in the large cities, but we do not all live in the large cities. That being the case we have to use what we have at hand, and when we look over our possessions we are surprised to find the wealth of material we have at hand. A good bow can

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be made of many of the native American woods, and the best in the world out of Oregon yew. I say best for the reason that it has been proven in actual contest that they will shoot as well as the imported English and Italian yew bows and last longer. But then we do not all live in the Oregon mountains where this wood is obtainable, so we must look some where else. We do not have to look far, for in fact any wood will make a bow. Of course some is much better than others, but the fact remains that with proper attention given to the grain of the wood and sufficient length provided a bow can be made out of the most brittle wood. But, of course, a bow of nine feet in length would be out of the question, and that would be the length you would have to make your bow in order to use some of the woods we have at hand. The most common wood that is used for boys and Indian bows is hickory, but there are other woods easily obtained that are much better. After use hickory seems to lose its cast, due to the fibre of the wood becoming crushed in the belly of the bow. You know that every time a bow is drawn to its capacity the fibre in the belly is crushed or pressed

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together while that in the back of the bow is pulled and stretched. Hickory will stand this pulling but fails when it comes to the crushing test. This characteristic of hickory is taken advantage of by bow makers when they make what is called a backed bow or one made of two pieces of different woods. They select for the belly a wood that will stand crushing, as for instance red cedar, the sweet smelling kind that is used for making pencils, and hickory for the back, and produce a bow that is as good as the best. But then we have not come to that yet. We will tell you about backed and grafted bows later on.

If you have access to growing timber you can select your own bow material, and thus, have the advantage of the city dweller who will have to get his at the lumber yard or wagon shop and be compelled to put up with old and brash wood which in all probability will be kiln dried and consequently ruined. Select a sapling or young tree of from three to five inches in diameter, the trunk of which is straight and free from knots or limbs. In making your selection you can take either mulberry, black locust, sassafras, apple, black walnut, osage orange, elm, ash, hemlock,

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dogwood, and if you find nothing better, hickory. Among these woods mulberry and black locust are considered the best, but you are not justified in refusing to use any kind of wood you can get that has a long straight grain and that is not notoriously brittle. Experiment, and you might find a better bow wood than has been heretofore discovered. When you have selected your sapling cut a piece from the trunk not less than six feet long. The length of your bow will depend upon your size and strength. Your bow should be as long as you are tall, but at least six feet long. For a youth fourteen or fifteen years of age the bow should be five feet and three inches or better still five feet and a half. A short bow is liable to break, and while it has a "snappy" cast, it is not pleasant to use. A safe rule is to make your bow of such length that you can easily brace, or string, it by the method to be hereafter explained. After securing your tree trunk you must remove the bark and then saw the piece lengthwise through the middle. This will give you material for two bows, and if you have selected a sapling large enough you can saw each half through the middle and will then

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have four quarters for the same purpose. You will find that there is a marked difference between the heart and sap of the wood, both in looks and quality and we will take advantage of this fact later on. Of course the wood we have is green and unseasoned and before we use it we will have to season it. This is done by finding a running stream of water, if we can, and by weighting our sticks we keep them in the water for from two to six weeks, depending upon their size and the nature of the wood. A wood with a close compact grain will require more time than one with an open porous grain. The theory in this method of seasoning, and it is proven in practice, is that the sap in the wood is supplanted by the water, and when the water is subsequently driven out the grain of the wood is left tough and elastic, rather than dry and brittle, as would be the case if the wood was allowed to season in the air. This is shown by the fact that kiln-dried timber is almost invariably brash and liable to fracture upon the slightest strain. Of course if you cannot find a stream to immerse your sticks in you will have to put them in a trough, tank or cistern. Running water simply accelerates

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the elimination of the sap. Of course if you live in the city and have to buy your bow material you will get it already seasoned, but be sure you do not get kiln-dried if you can possibly help it. Osage orange makes a good bow but it is very liable to weather check, and when seasoned is hard to work. Cedar is also good, but it is very hard to secure pieces of sufficient length, free from knots. I have made a most excellent bow from a piece of sassafras secured from a two inch board sixteen inches wide. A sapling of this wood should make a desirable bow.

While our material is seasoning we will discuss the size of our bow. The strength, and consequently the casting power of a bow is determined by the number of pounds it is necessary to pull upon the string in order to pull it back the full length of the arrow and called weight. This statement, as far as the casting power of a bow is concerned is only partially true as some bow woods are much quicker than others, and with two bows of equal weight, i. e., pull, but made of different woods one is liable to have a farther cast. It is this characteristic that makes yew so valuable, not this alone, however, as snake-

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wood has a quicker cast, but is rejected by veteran archers on account of being heavy, and its liability to jar and fragility. A bow for a man should range in weight from 35 to 70 pounds, depending upon the individual and whether the bow is for target shooting or hunting. The main thing to be guarded against is to not get a bow that is too strong for the shooter. To shoot with a bow beyond your strength results in poor scores, sore fingers and ultimate disgust and condemnation of a pastime, the beauties of which you have denied yourself in attempting to impress upon your fellows that you were possessed of superior physical prowess. The best archers use a bow many pounds lighter than they are capable of using. Archery is not a test of strength, but of skill and the intelligent use of such powers as we possess. Of course as the archer masters his bow he will increase in strength and should in just that proportion increase the weight of his weapon.

The weight of a bow is determined by its length, the amount of material left in it and the quality of the wood. The hard dense woods such as ash, hickory and osage orange will require less bulk than the softer woods

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such as sassafras or cedar. In all probability your bow will range in size from ¾ inch to 1⅛ inch square at the largest part. A lance wood bow 1 inch square will weigh 65 pounds while a sassafras bow of the same size would weigh about 25 pounds. The shorter a bow of given size the more it will weigh. We cannot determine in advance just how large the finished bow will be but will have to ascertain that by experiment and repeated trials, so a safe rule is to make your bow larger than you have reason to believe will be acceptable and then reduce it to correspond to your strength.

After your stick has been taken from the water, wiped off and dried in the shade for three or four days and then hung up over the kitchen stove for a week it will be ready to work upon. For your first trial select your poorest stick to practice upon. If it is a success in the first instance you have in reserve a better stick more thoroughly seasoned from which you can make a better and stronger bow as you increase in skill and strength. After determining the length you want your bow, measure your stick and cut a piece as long as you want the bow to be from nock to nock, that is if you intend to use horn

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tips, but if it is your intention to cut notches in the bow itself to carry the string then you must cut your stick four inches longer than you want the finished bow. The sap of the wood is tough and elastic, it must be used for the back while the more dense heartwood is used for the belly. Square up the edges of your piece with a drawing knife so that it may be firmly held in the vise with the sap uppermost, in doing so you can shave it down until it is 1⅛ inches wide, but do all of this work on the edges, not on the sap or heart of the stick. Now comes the important part and the durability and life of your bow depends upon your careful attention to this feature of its manufacture. Now place your stick, which by this time has been reduced by the drawing knife and its two sides planed smooth with the jack-plane, in the vise with the sap uppermost. Study the grain of the wood. Does it run true, flat and even, or does it dip and thicken up in places, if it dips, does the same increased thickness show upon both sides of the stick? Now we must reduce this sap so that we will leave a layer from ⅛ to 3/16 of an inch in thickness along the back of our bow, and in doing so we must

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follow the grain of the wood as nearly as possible. Of course any slight wave or depression we can ignore, and make our back practically level and flat, but if we encounter a pronounced bend or depression in the grain of the wood we must follow it. In other words a bow which has the grain of the wood "running out" or cut across on the back will not last. The cheap lance and lemonwood bows are finished with the back perfectly smooth, while at a meeting of the National Archery Association will be found bows costing as high as one hundred dollars and made of yew in which the back is far from straight, owing to the grain of the wood being followed in their making. However the sides of these are, and all bows should be, perfectly straight, so that when they are strung up and you look along the string and at the belly of the bow the string divides the bow equally.

Now if you have followed the instructions above given you have a billet of wood 1⅛ inches wide, with a layer of sap along its entire length of about $\frac{3}{16}$ inch in thickness and more or less rounding, depending upon the size of the sapling in the first instance. If this convexity is too pronounced the centre

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may be slightly reduced so as to make the back almost flat, that is, flat across the grain. Now measure your stick and find its centre and mark it. From this point make a mark 1 inch above and 3 inches below. This is for the handle. Mark these last two points by drawing lines squarely across the back of the stick, and, of course, four inches apart. With a chalk line pulled very taut mark the centre of the back from end to end. At both ends of the stick mark a point $\frac{5}{16}$ inches from either side of the chalk mark. Draw lines with a straight edge from these points to the ends of the cross lines which you have used to mark the handle. Now with the drawing-knife at first and plane afterwards reduce the sides of your stick to these marks, and have the sides at right angles to the plane of the back.

Now turn your stick on its side and mark a point at either end $\frac{5}{8}$ of an inch from the back, and 1 inch from the back at either end of the handle, connect these points with a line. Then reduce the heart of the stick in the same manner you reduced the sides. You now have a stick $\frac{5}{8}$ inch square on the ends and the centre of which is 1 x 1$\frac{1}{8}$.

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The handle, so far untouched, should be rounded on the inside, care being taken from now on that the back remains untouched, and should be made as large as can be conveniently held in the hand, and noticeably larger than the largest part of the finished limbs of the bow. When the bow is fully drawn it should not bend, even the slightest, in the handle, for this reason we are compelled to leave a lot of wood at this point. The measurements we have been working to we will find are for a bow probably stronger than we can pull, but we have taken this precaution in order to get our handle large enough, and having secured that necessary condition we will proceed to reduce the size of each limb by planing them on the belly and sides down to the required size. These measurements will vary somewhat depending upon the kind of wood we are using. The corners of the belly are rounded and planed off so that a section of the bow at any point if sawed through would look like a letter U which was almost if not quite as deep as it was wide; for instance if one of the limbs was 1 inch wide and ⅞ inch deep at the largest part it would be probably ½ inch wide and

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$\frac{7}{16}$ deep at the ends. It will be impossible to plane the belly to within 4 or 5 inches of the handle, as to do so would make it the same size of the limbs, when it should be at least a quarter of an inch deeper, so at this point it will be necessary to carefully taper the handle into each limb by the use of the drawing knife, spoke shave, rasp or scraper. The handle may be wider than the limbs, however, without harm.

In reducing the belly of the bow we must be careful to follow the lines of the bow as determined by the back. The back is the base line from which we work, and if there is a kink or depression in it we must have a corresponding bulge or raised place in the belly. Another thing to bear in mind is that if we encounter a knot of small proportions, commonly called a pin knot, we must not condemn the stick and throw it away, as we may save it by doing what is called "raising" the knot, that is, leave the knot and the surrounding wood higher than the limb on either side of the knot. Many excellent bows are thus constructed. They look rough at rest but in use bend with a graceful curve if properly made.

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The ends of the bow will be finished by filing with a small rat-tail file notches on either side for the string, care being taken to leave no sharp corners that are liable to cut, or placing horn tips thereon, as fancy dictates. If you want horn tips, and they are the most satisfactory, secure two inches from the tip of a cow's horn and drill a one-eighth inch hole in the larger end and one inch deep. Make a reamer of flat steel one inch long running to a point and as wide at the base as the tips of your bow. Sharpen the edges of this reamer with a file at an angle similar to the blade of a pair of scissors and having left a shank, on your reamer put it in a brace and ream out the hole in the horn to fit the ends of your bow which will be sharpened like a pencil to fit the tips. Sharpen a hard wood stick to fit in the tips and clamp the stick in the vise and with rasp, file and scraper fashion the tip to suit your fancy. File a notch in the tip to hold the string, making it round and smooth and at such an angle that the string will rest on the bottom of the notch when the bow is strung. The top of the notch should be cut away so that when the bow is fully drawn it will not interfere

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with the string. If the horn works too hard it may be softened by boiling. Finish with emery paper.

The horn tips may be securely fastened on the ends of the bow with glue.

To brace or string the bow slip the eye of the string over the upper end and fasten the lower end with a timber hitch, so that the eye will be about two and one-half inches below the upper nock. The bow is strung by holding the lower limb with the inside of the foot, pulling upon the handle with one hand and depressing the upper limb with the other, at the same time slipping the eye of the string into the upper nock. Use either hand to grasp the bow at the handle as suits your convenience, and you will find that whichever hand you select you will use the foot on that side of the body to hold the lower limb.

Now examine the bow and see if it bends evenly throughout its entire length. Look along the back lengthwise and see if it bends even and flat or if it pulled out of shape by the string. If the latter is the case and the string does not cut the middle of the bow it will be necessary to cure this defect by scraping that side of the belly which is opposite

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the portion of the back which is bulged out; in other words, scrape the low side of the belly. Do this very gradually and carefully and closely watch the result of your efforts. If one limb bends more than the other the stronger limb must be reduced to correspond. Remember the handle must not bend in the least and each limb must bend with an even graceful curve from the handle to the tip. After getting the bow to bend to suit you it must be weighed. To do this adjust your string so that when the bow is braced it will stand from 6 to 6½ inches from the inside of the handle, and with a spring balance draw the string, at its centre so that it will be 27 inches from the inside of the handle. If the spring balance shows that the bow weighs the required amount, well and good, if it is stronger than you want then the bow must be lowered or weakened by scraping it evenly throughout its entire length, taking off but little at a time and frequently testing to see that we do not go too far, and being careful that we scrape one side as much as the other in order to preserve the balance. Another way to test the bow is to weigh out in a sack as much sand or soil as necessary to give you

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the desired weight, and tie it up and affix a hook thereon. Drive two very stout nails at a convenient height above the floor and 4 inches apart; mark a point on the wall 27 inches below these nails; hang your bow on these nails by the handle and hook the bag of sand in the centre of the string. When the bag of sand will pull the string down to the mark you have a bow of the required weight. Of course in making this test or the one with the spring balance you must not allow the bow to be under strain any length of time; hang on your weight, ease it down to the point where the bow will hold it, note the distance and immediately remove the weight.

To finish the bow it must be rubbed perfectly smooth with sand paper or steel wool, and the pores of the wood filled with a filler if necessary. Three coats of rubbing varnish or Chinamel, well rubbed between each coat should give a nice finish. If the handle is large enough, and of such shape as to feel pleasant to the hand nothing additional will be required beyond the trimming, however if it is small and hard to grasp it must be increased in size and improved in shape by glueing upon the back a piece of pine as

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long as the handle and nicely rounded. The trimming will be a piece of green or red plush glued around the handle, or any other material that suits your taste. In locating the handle you must remember that it is not in the exact centre of the bow but between the marks we put on the back as guides, which results in the upper limb being longer than the lower. This disparity in length causes the upper limb to bend more than the lower, so that if the bow when braced shows a very slightly increased bend in the upper limb it is not objectionable. Barnes, the famous American yew bowyer trims his handles with strips of split leather wound around the handle. A good covering would be a piece of calf skin, cut to fit, and sewed along the back with the base-ball stitch.

Soft wood bows should have a piece of ivory, mother of pearl or any other hard substance let into the left side of the upper limb just above the handle, to allow the arrows to glide over without wearing the bow at that point. This is called the arrow plate.

The bow which is now finished and ready for use is what is called a self bow, that is one made without a back. There is another kind of bow which is a self bow but is made

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of two pieces joined in the handle, and it is known as a grafted bow. As it is hard to get a piece of yew of sufficient length, and sufficiently clear of knots and pins to make a perfect bow, the grafted variety is very common in bows of that wood, and they are entirely satisfactory, that is if well made. Expert bowyers claim that there is a difference in the quality of the wood in either end of a six foot stick, and for that reason indorse the grafted bow for the reason that wood of the same quality and from a half length of the same stick may be placed in either limb of the bow, with uniform results. If you are unable to get a clear stick of sufficient length to make a bow you should have no difficulty in getting a stick of half that length, and large enough to get two limbs from it. Prepare your sticks by reducing the sap as you did for the bow just described, and select the butt end of the stick for the joint. To make the joint you must make the ends of your limbs perfectly square for a distance of four inches. This may result in cutting across the grain in the handle, but as the bow will not bend there and will be protected by a whipping it will be of no consequence. In squaring the

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ends you must remember that in the finished handle there must be left sufficient wood to give it rigidity. On the back of one of the limbs mark it in the shape of a W which is upside-down, as wide as the stick and at least three and one-half inches long; carefully mark the belly to correspond. Clamp the stick securely in the vise and with a fine saw cut out the V shaped piece in the middle and with drawing-knife and plane cut off the long triangular pieces on either side down to the outside mark. If you do not get this sawed out accurately it will be necessary to dress it up with a knife-edge file, using the utmost care to keep the surfaces flat and true. Saw two deep notches in the other limb, first marking them out, so that when finished the one limb will fit into the other and the sides of the two limbs be parallel. The two things to be watched in making this joint are to see that it is a perfect fit on both the back and belly, and that when the stick is joined it will be straight. This joint is called a double fish joint and is very strong. Now with the best glue that you can procure, the same having been put to soak in cold water over night, and then boiled in a glue pot, or water

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bath, and used while boiling hot, thoroughly coat the proposed joint getting the glue into every portion of the joint and fit the pieces together, driving them smartly home with a mallet, and clamp the joint very firmly in the vise until dry. In a day or two the glue will be sufficiently hard to allow you to work on the stick and reduce it to about the proper size and shape for the proposed bow. Now you will have to put a whipping of very stout cord or tape around the joint, starting well outside of the ends of the joint, winding close, smooth and as tight as your whipping will allow. This whipping should be laid on in glue, and after completed if it will not make too much bulk in the handle you should put on a double or triple whipping. There is a very severe strain on this joint and you cannot make it with too much care nor too strong. The more whipping you put on and the tighter you draw it the better will be your joint. Let the glue in this whipping dry at least a week before you attempt to brace the bow, which, of course, you have not attempted before the whipping was on. This bow will be finished the same as the former one excepting that the whipping will

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receive repeated coats of varnish to make it absolutely water-proof.

The backed bow is a most excellent weapon and one in which hickory demonstrates its peculiar merit, as most all backed bows are made with such backs. To make one secure a piece of well seasoned second growth white hickory of the width and length you want your bow and when planed and smoothed up of three-sixteenth inch in thickness. Excellent backs may be secured by procuring from a carriage maker or hardwood dealer a buggy reach or coupling. These are six feet long and 1¼ inch square. By looking over a large stock you can most likely find several in which the grain is straight and even and does not run out, which when taken to the planing mill and ripped on a circular saw will afford material for three or four backs; use sharp saw. Carefully dress the back you select with a sharp fore-plane. The belly will be made substantially as wide as the back, at least in the centre, and of sufficient depth to leave plenty of wood in the handle. The back of the belly must be planed smooth, true and straight, and upon this planed surface the back must be glued. The

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surfaces to be glued should be combed with a fine toothed saw. The glueing process is the difficult part of the job. The glue must be of the best, in perfect solution and boiling hot. As soon as it is applied to every portion of both surfaces, immense pressure must be exerted upon the two sticks to force out all surplus glue. You can exert this pressure by means of wedges or cabinet makers clamps. If you use the former method nail two inch planks parallel to each other and about three inches apart on your bench and provide a series of short double wedges for the entire length of the bow and so arranged that the small square end of one is snug against the large end of the next one and so on. By driving the end wedge all are thus moved and a uniform pressure is exerted from end to end. If you use clamps use as many as you can put on, and clamp the bow, back down, to a two inch board. This board keeps the back straight while being glued on. Do not take the bow out of the clamps for a week. Dress down and finish as for a self bow.

It requires nice adjustment to make your wedges so that by driving the end wedge all will be equally tightened and you can get

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almost as good results by leaving a space of three-quarters of an inch between each set, and driving each wedge individually. They may be driven by a notched hard wood stick. Drive them all they will stand. To make a good glue joint immense pressure is necessary and you must remember this is making a grafted as well as a backed bow. In making the joint in the grafted bow if the jaws of your vise are not exactly as wide as the joint you should cut hard wood blocks just the length of the joint and place them on either side of the joint and clamp the whole in the vise. If the blocks are longer than the joint the solid wood will take the pressure that is intended for the joint. Another thing, while the back and belly are to be planed perfectly true and flat where they are to be glued, they should not be left smooth but the surfaces should be scored by scratching them lengthwise with a fine toothed saw, as explained. There are special planes made for this purpose. The roughened surface gives the glue a better opportunity to take hold.

While hickory, next to yew, is the best for backs there are several woods that are excellent for bellys. Among them are red

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cedar, the heart wood of black locust, black walnut, mulberry, osage orange, and sassafras.

While the directions herein given are general in their nature they are intended to cover the making of an ordinary sized bow for a man. Of course if the bow is wanted for a woman or a youth the length and size of the bow must be reduced accordingly, as well as the draw. The ordinary length of men's arrows are 28 inches and they require a bow of at least 6 feet in length. Among my bows I have one 3 inches over 6 feet, which weighs 65 pounds and it has stood a lot of hard usage in the wild. While we have given the weight of bows for men as ranging from 35 to 70 pounds the limits are not hard and fixed. For target use 45 pounds will be found to suit the average man. Many expert archers including Thompson, Taylor, Richardson, et al., use a heavier bow, at the targets, while other experts use lighter than the weight indicated. When hunting we require a much heavier bow, for the reason that the arrows are very much heavier than the fragile target arrow. They are weighed in ounces not shillings. Then the bow is more constantly used than at the targets, and there is no

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dwelling on the aim. The result is that we can without effort fully draw a bow that weighs 20 to 25 pounds more than the bow we are accustomed to use at the targets. If you have a good, well finished target bow do not run the risk of ruining it in hunting. You will scratch and mar it in the underbrush and the quick snappy draw you give when your game is sighted may result in its fracture. Make yourself a hunting bow of hard wood and follow the call of the wild. There is nothing like it.

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